## REMARKS

### STATUS OF THE DRAWINGS

The Office objected to the drawings under 37 CFR 1.83(a), asserting that processor and sensors must be shown or the features(s) canceled from the claims. Applicant has canceled claim 16 which recited these features.

### STATUS OF THE CLAIMS

Claims 1-15 and 17-22 remain in the application. Claim 16 has been canceled. Claims 1, 3, 6, 7, 13, and 20 have been amended.

The Office rejected claim 16 under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

The Office rejected claims 1-22 under 35 U.S.C. 112, second paragraph, as being indefinite.

The Office rejected claims 1-3, 15, 19, 21, and 22 under 35 U.S.C. 102(b) as being anticipated by *Rosheim*.

The Office rejected claims 4, 5, and 9-12 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Salisbury*.

The Office rejected claims 6 and 7 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Arai*.

The Office rejected claims 8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Hendzel*.

The Office rejected claims 16-18 and 20 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Shahoian*.

### SUMMARY OF THE INVENTION

The present invention is directed to a device for transmitting a movement having a parallel kinematics transmission structure providing three translational degrees of freedom.

### SUMMARY OF THE ART

*Rosheim*, U.S. 6,038,940, discloses a controlled mechanical carrier motion system.

*Salisbury et al.*, U.S. 5,046,375, discloses a pretensioned cable that transmits power along a first support member (link) from a rotary actuator to a rotating output joint.

*Arai et al.*, *Development of 3 DOF Micro Finger*, Proc. IROS 96, 981 (1996), discloses a 3 degree-of-freedom micro finger that has pure translational motion.

*Hendzel*, U.S. 6,412,844, discloses a robotic gripper mechanism.

*Shahoian et al.*, U.S. Pat. Pub. No. 2001/0000663, discloses a haptic feedback device with button forces.

**ARGUMENTS**

REJECTION OF CLAIM 16 UNDER 35 U.S.C. § 112

The Office rejected claim 16 under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. Specifically, the Office asserted that the specification does not provide support for a processor which calculates the position of the moveable member based on the results of measuring the aperture angle of each control arm. Applicant has canceled claim 16.

REJECTION OF CLAIMS 1-22 UNDER 35 U.S.C. § 112

The Office rejected claims 1-22 under 35 U.S.C. 112, second paragraph, as being indefinite.

With regards to claim 1, the Office states that the claim recites "at least one moveable member... each providing three translational degrees of freedom' in lines 2-3 and asserts that the phrase "at least one" requires only one but not more and the term "each" seems to be implying that more than one is being claimed. Applicant has amended claim 1 to clarify that each of the at least one parallel kinematics transmission structure provides three translational degrees of freedom. Accordingly, Applicant submits that claim 1 is now in condition for allowance.

With regards to claim 3, the Office asserts that the term "close" in the claim is a relative term which renders the claim indefinite. Applicant has deleted the limitation of "a close relationship to each other" from claim 3. Accordingly, Applicant submits that claim 3 is now in condition for allowance.

With regards to claim 6, the Office asserts that there is insufficient antecedent basis for the limitation "the articulations" in the claim. Applicant has amended claim 6 to recite "ends of the control arm and linking bar of each parallel kinematics transmission structure comprise articulations and where at least one of the articulations of the parallel kinematics transmission structure comprises a flexible hinge articulation". Applicant submits that this recitation provides

sufficient antecedent basis for the limitation "the articulations." Accordingly, Applicant submits that claim 6 is now in condition for allowance.

With regards to claim 7, the Office asserts that there is insufficient antecedent basis for the limitation "linking bar" in the claim. Applicant submits that the limitation "linking bar" in claim 7 has antecedent basis in amended claim 1. Applicant has amended claim 7 to delete the limitation "base member" which does not have sufficient antecedent basis in claim 1. Accordingly, Applicant submits that claim 7 is now in condition for allowance.

With regards to claim 20, the Office asserts that there is insufficient antecedent basis for the limitation "the wrist module" in the claim. Applicant has amended claim 20 to depend from claim 17, which provides sufficient antecedent basis for the limitation "the wrist module" in claim 20. Accordingly, Applicant submits that claim 20 is now in condition for allowance.

Applicant submits that claims 1, 3, 6, 7, and 20 are now in condition for allowance. Furthermore, Applicant submits that claims 2, 4-5, 8-15, 17-19, and 21-22, which depend from and further define claim 1, are likewise in condition for allowance. *See* MPEP 2143.03.

REJECTION OF CLAIMS 1-3, 15, 19, 21, AND 22 AS ANTICIPATED BY *ROSHEIM*

The Office rejected claims 1-3, 15, 19, 21, and 22 under 35 U.S.C. 102(b) as being anticipated by *Rosheim*. To anticipate a claim, the reference must teach each and every element of the claim. *See* MPEP 2131.

Applicant has amended claim 1 to recite "each of the at least one parallel kinematics transmission structure comprising a control arm pivotable over a rotation axis at one end and a linking bar hingedly mounted on one end to the other end of the control arm and on the other end to the at least one moveable member and having at least two rotational degrees of freedom at both ends, thereby providing each parallel kinematics transmission structure with three translational degrees of freedom." Support for this amendment is found in the Application at paragraph [0058] and FIGS. 2a, 2b, and 2c.

With respect to claim 1, *Rosheim* teaches members comprising a lower pivoting link 20 that is rotatably coupled to base support 12 on one end by a pin or pivot screw 22 and rotatably coupled to a pivot holder member 25 on the other end by pin or pivot screw 24, and an upper pivoting link 30 that is rotatably coupled to a pivot holder member 25 on one end by pin or pivot screw 27 and rotatably coupled to tilting manipulable support 32 on the other end by pin or pivot screw 29. *See Rosheim*, col. 3, line 46, through col. 6, line 33; and FIGS. 1, 2, and 3. Therefore,

each of *Rosheim's* pivoting links has only one rotational degree of freedom at each end. As a result, *Rosheim's* manipulable support will tilt unless the rotations of the opposing members are matched in the same direction so that the manipulable support is lifted vertically. *See Rosheim*, col. 4, lines 23-31, and FIG. 4.

Conversely, Applicant claims parallel kinematics transmission structures 3 comprising a control arm 10 pivotable over a rotation axis 11 at one end and a linking bar 20 hingedly mounted on one end to the other end of the control arm and on the other end to the at least one moveable member and having at least two rotational degrees of freedom 21 and 22 at both ends, thereby providing each parallel kinematics transmission structure with three translational degrees of freedom. An advantage of the linking bar comprising two rotational degrees of freedom at both ends is that Applicant's moveable member can always be in a plane parallel to the base member of the device. Applicant submits that *Rosheim* does not teach or suggest this limitation.

With respect to claim 2, *Rosheim* teaches a carrier with four arm arrangements (i.e, in the shape of a square). *See Rosheim*, col. 3, line 64 through col. 4, line 18; and FIGS. 1-3. Conversely, Applicant teaches and claim 2 recites three parallel kinematics transmission structures in a delta type arrangement (i.e., in the shape of a triangle). *See* Application, Abstract and FIGS. 3A and 4. Applicant's delta type arrangement provides three translational degrees of freedom in a very compact device.

Applicant submits that this rejection is overcome and that claim 1 is in condition for allowance. Furthermore, Applicant submits that claims 2-3, 15, 19, 21, and 22, which depend from and further define claim 1, are likewise in condition for allowance. *See* MPEP 2143.03.

REJECTION OF CLAIMS 4, 5, AND 9-12 AS MADE OBVIOUS BY *ROSHEIM* IN VIEW OF *SALISBURY*

The Office rejected claims 4, 5, and 9-12 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Salisbury*. To establish a *prima facie* case of obviousness, the prior art must teach or suggest all the claim limitations and there must be some reasonable expectation of success. *See* MPEP 2143.

With regards to claim 4, *Salisbury* teaches a cable transmission system comprising a rotary actuator 14 that transmits power to an output pulley 16 that articulates a link arm 18 bidirectionally. However, the axis of rotation 28b of the rotary actuator 14 and the axis of rotation 16a of the output pulley 16 are parallel. *See Salisbury*, FIG. 2. Conversely, Applicant teach and

claim 1 (from which claim 4 depends) recites a rotative actuator 30 that is arranged such that its axis 31 is substantially perpendicular to the rotation axis 11 of the control arm 10. *See* Application, paragraph [0053] and FIG. 3b. Therefore, Applicant submits that combining *Rosheim* and *Salisbury* would require a substantial reconstruction and redesign of *Rosheim's* device and a change in the principle of operation of *Salisbury's* parallel actuator/pulley system. *See* MPEP 2143.01.VI.

With regards to claims 11 and 12, Applicant's redirection member maintains an essentially perpendicular incidence of the cable on the shaft of the rotative actuator. The redirection member 70 is necessary to redirect the axis 31 of rotative actuator 39 to the substantially perpendicular rotation axis 11 of the control arm 10 and pulley 72. Without the redirection member the angle of incidence of the cable on the shaft would change depending on the angle of the control arm of the parallel kinematics motion transmission structure. *See* Application, paragraphs [0040] and [0065] and FIG. 3b. Applicant submits that *Rosheim's* pulley 20a is not a redirection member, as asserted by the Office, because the axis of rotation of 28b of the rotary actuator 14 is parallel to the axis of rotation of pulley 20a and pulley 16. *See Rosheim*, FIG. 2. Therefore, *Rosheim's* pulley 20a is not necessary to maintain the angle of incidence of his cable 19 on spool 32 or pulley 16.

Further, Applicant has argued, *supra*, that claim 1 is in condition for allowance. Therefore, Applicant submits that claims 4, 5, and 9-12 which depend from and further define claim 1, are likewise in condition for allowance. *See* MPEP 2143.03.

REJECTION OF CLAIMS 6 AND 7 AS MADE OBVIOUS BY *ROSHEIM* IN VIEW OF *ARAI*

The Office rejected claims 6 and 7 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Arai*. Applicant has argued, *supra*, that claim 1 is in condition for allowance. Therefore, Applicant submits that claims 6 and 7, which depend from and further define claim 1, are likewise in condition for allowance. *See* MPEP 2143.03.

REJECTION OF CLAIMS 8, 13 AND 14 AS MADE OBVIOUS BY *ROSHEIM* IN VIEW OF *HENDZEL*

The Office rejected claims 8, 13, and 14 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Hendzel*. To establish a *prima facie* case of obviousness, there must be some suggestion or motivation to modify or combine the reference teachings. *See* MPEP 2143.

Applicant has amended claim 13 to properly depend from claim 8.

*Hendzel* teaches a torsion spring 54 that bias a finger assembly 48 to a retracted position. *See Hendzel*, col. 3, line 63, through col. 4, line 5; and FIGS. 2C and 3C. *Rosheim* teaches a rotary electric motor 15 that is in positive engagement with pivoting link 20 either by crank arm 19 that is directly affixed to the pivoting link or a first bevel gear 15' that is engaged with a further bevel gear 15" that is affixed to the pivoting link, thereby forcing the pivoting link 20 to positively rotate in either a clockwise or counterclockwise direction in direct response to the direction of rotation of the electric motor. *See Rosheim*, col. 3, lines 6-13; col. 7, lines 6-17; and FIGS. 1 and 2. Therefore, *Rosheim's* crank arm or bevel gear operates on the pivoting link bidirectionally, so that a restoring member could not be used with *Rosheim's* device. Accordingly, the Office's proposed modification of *Rosheim* with *Hendzel's* restoring torsion spring would render *Rosheim's* device unsatisfactory for its intended purpose. *See* MPEP 2143.01.

Conversely, Applicant's rotative actuator 30 exerts a tensile action on the respective control arm through a cable 51. By nature the cable can only exert traction. Therefore, the restoring element 80 provides a restoring force against the tensile action of the rotative actuator. The restoring element may be a leaf spring, a helical torsion spring, a spiral spring, an elastic element or the like. The restoring element prestresses the control arm such as to "open" the control arms of the motion transmission structure. *See* Application, paragraph [0034] and FIG. 3b. Therefore, Applicant's rotative actuator can only act on the cable unidirectionally, therefore requiring a restoring element to return the control arm to an open position.

Applicant submits that the Office has not established a *prima facie* case of obviousness. Accordingly, Applicant submits that this rejection is overcome and that claim 8 is in condition for allowance. Furthermore, Applicant submits that claims 13 and 14, which depend from and further define claim 8, are likewise in condition for allowance. *See* MPEP 2143.03.

REJECTION OF CLAIMS 16-18 AND 20 AS MADE OBVIOUS BY *ROSHEIM* IN VIEW OF *SHAHOIAN*

The Office rejected claims 16-18 and 20 under 35 U.S.C. 103(a) as being unpatentable over *Rosheim* in view of *Shahoian*. To establish a *prima facie* case of obviousness, the prior art must teach or suggest all the claim limitations and there must be some reasonable expectation of success. *See* MPEP 2143.

Applicant has canceled claim 16.

With regards to claim 17, *Shahoian* does not teach the limitation of a wrist module arranged in series with the parallel transmission structure and adapted to provide at least one rotational

degrees of freedom. *Shahoian's* linkage 20 includes members 26, 28, 30, 32, and 34, where each of these members is rotatably coupled to other members in a serial fashion by joints 27, 29, 31, and 33, respectively. Furthermore, base member 26 is rotatably coupled to ground surface 24 by a joint 35 and controller 22 is rotatably coupled to end member 34 by a joint 37. *See Shahoian,* paragraphs [0035] and [0076] and FIGS. 1 and 8. Therefore, *Shahoian's* joint 37 is merely a pin joint that enables coupling of controller 22 to end member 34 but does not provide an independent rotation of his linkage in response to rotation of the hand 40.

Conversely, because Applicant's wrist module 93 is arranged in series with the parallel transmission structure 3, Applicant's haptic device decouples translations from the rotations provided by the wrist module. *See* Application, paragraph [0052]. This enables an independent rotation of Applicant's haptic device in response to a rotation of the hand.

Neither *Rosheim* nor *Shahoian* teach or suggest the limitation of a wrist module arranged in series with a parallel transmission structure. Therefore, Applicant submits that the Office has not established a *prima facie* case of obviousness. Accordingly, Applicant submits that this rejection is overcome and that claim 17 is in condition for allowance. Furthermore, Applicant submits that claims 18 and 20, which depend from and further define claim 17, are likewise in condition for allowance. *See* MPEP 2143.03.